Canada-Manitoba

FLOOD DAMAGE REDUCTION PROGRAM

Annual Report

1985-1986

November 1986

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Canada Manitoba

Canada-Manitoba Flood Damage Reduction Program
— Steering Committee

The Honourable Thomas McMillan
Minister
Department of the Environment
Ottawa, Ontario
K1A 0H3

The Honourable Leonard Harapiak
Minister
Department of Natural Resources
Winnipeg, Manitoba
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Gentlemen:

I am pleased to present the ninth Annual Report of the Canada-Manitoba Steering Committee on the Flood Damage Reduction Program. This report covers the progress made during the period April 1, 1985 to March 31, 1986. The work in the program is authorized by the Agreement Respecting Flood Risk Mapping and the Agreement Respecting Studies for Flood Damage Reduction signed by Canada and Manitoba on December 20, 1976, by the Amending Agreement signed on March 31, 1981, by the Amending Letters of Exchange signed on September 6, 1985, and by the Agreement Respecting Flood Forecasting signed on March 31, 1981. Further amendments were requested in the period of this report.

In order to meet the objectives of the Agreement Respecting Flood Forecasting a time extension of three and one-half years and additional funding of $400,000 were requested. The request was not approved during the period of this report. Accordingly, the Agreement Respecting Flood Forecasting expired on March 31, 1986.

Progress on hydrology and hydraulic studies for designation of flood risk areas was impeded during the period of this report because of the expiry of the Agreement Respecting Flood Risk Mapping on December 31, 1984. The Agreement was extended on September 6, 1985. The major impact of the delay in extension of the Agreement was the postponement of designation of flood prone lands.

During the reporting period, expenditures totaling $235,501.54 were shared equally between Canada and Manitoba for flood risk mapping, flood damage reduction studies and flood forecasting programs.

Yours truly,

N. Mudry, P. Eng.
Chairman, Steering Committee
1577 Dublin Avenue
Winnipeg, Manitoba
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CANADA-MANITOBA

FLOOD DAMAGE REDUCTION PROGRAM

ANNUAL REPORT

FOR

THE PERIOD

APRIL 1, 1985 TO MARCH 31, 1986

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November, 1986

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A. Areas and Floodways to be Mapped in the Province of Manitoba

B. Location of Areas in the Canada-Manitoba Flood Risk Mapping Agreement

SUMMARY

Work continued on completing the base mapping at three communities under the Agreement Respecting Flood Risk Mapping. These communities are the Town of The Pas, the Town of Virden and unmapped areas of the La Salle, Assiniboine and Red rivers within the City of Winnipeg.

This Agreement expired on December 31, 1984 and work was halted. An extension to the Agreement was signed on September 6, 1985 and work resumed.

The hydrology and hydraulic studies for Arborg were revised and completed. The hydraulic studies for Fisher Branch and Riverton were completed. Hydrology and hydraulic studies for Omands Creek in Winnipeg was initiated. Studies were initiated for the communities of Elie, Morden and Riverton under the Agreement Respecting Studies for Flood Damage Reduction.

The report on Phase One of the Agreement Respecting Flood Forecasting was completed. Work continued on Phase Two. Model calibration on Willow Creek, Gopher Creek and Elgin Creek was almost completed.

CHAPTER I

THE CANADA-MANITOBA FLOOD DAMAGE REDUCTION AGREEMENTS

On December 20, 1976, the Governments of Canada and Manitoba signed three agreements whose collective aim is to reduce the potential for flood damages in Manitoba over the long term. These agreements recognize that the best way to reduce potential flood damage is to keep flood prone development out of the floodplain. Protection of existing development could involve a combination of structural and non-structural alternatives, including allowing some flooding to occur once the potential for flooding has been identified.

I.1 Introduction

The ninth annual report reviews work activities and progress of the Canada-Manitoba Flood Damage Reduction Program during the period from April 1, 1985 to March 31, 1986.

I.2 General Agreement Respecting Flood Damage Reduction (FDR)

This Agreement outlines the policies respecting government undertakings and programs in flood risk areas and provides a coordinated framework for a number of implementation sub-agreements. Listed below are the agreements which are now in effect.

I.3 Agreement Respecting Flood Risk Mapping

This Agreement provides for a flood risk mapping program to determine and subsequently designate those urban areas within Manitoba that are

prone to flooding. Appendix A lists "Areas and Floodways to be Mapped in the Province of Manitoba" as described in Schedule A of the original Agreement Respecting Flood Risk Mapping, including the additions and deletions incorporated in the Amending Agreement (noted below). Provincial and federal Orders-in-Council were passed to add the main rivers in Winnipeg to Schedule A. A public information program is to be conducted to inform people of the merits of the program, and to encourage acceptance and active participation.

I.4 Agreement Respecting Studies for Flood Damage Reduction

This Agreement provides for studies in specific problem areas to determine the most suitable measures for reducing or mitigating the damaging effects of floods on existing developments.

I.5 Amending Agreement

In order to complete all the work scheduled in the Agreement Respecting Flood Risk Mapping and because of the need for additional funds, an amending agreement was negotiated between Canada and Manitoba during 1980/81. The major changes to the three flood damage reduction agreements were the extension of time and the increase in funding. The General Agreement Respecting Flood Damage Reduction was extended to December 31, 1990. The Agreement Respecting Flood Risk Mapping was extended to December 31, 1984 with additional funds of $1,490,000. The termination date of the Agreement Respecting Studies for Flood Damage Reduction was changed to December 31, 1985 with no additional funding. Beausejour was removed from the list of places to be mapped because no serious flood problem exists there. It was replaced by the Town of Gimli.

I.6 Amending Letters of Exchange

Further amendments to the three flood damage reduction agreements were negotiated between Canada and Manitoba and concluded by an exchange of letters on September 6, 1985. The amendments were necessary in order to carry out the work scheduled in the Agreement Respecting Flood Risk Mapping and the Agreement Respecting Studies for Flood Damage Reduction. Specifically, the amendments were an extension to the General Agreement Respecting Flood Damage Reduction from December 31, 1990 to March 31, 1994; an extension of the Agreement Respecting Flood Risk Mapping from December 31, 1984 to March 31, 1988 with additional funds of $160,000; and an extension to the Agreement Respecting Studies for Flood Damage Reduction from December 31, 1985 to March 31, 1989.

I.7 Agreement Respecting Flood Forecasting

This Agreement, a sub-agreement to the General Agreement Respecting Flood Damage Reduction, was signed by Canada and Manitoba on March 31, 1981. The objective of the Agreement is to improve the flood forecasting capability for the Red, Assiniboine and Souris rivers in Manitoba.

The Agreement is divided into two phases. The first phase includes a pilot project on the Boyne River to develop a suitable improved streamflow forecasting model and to test and evaluate alternate streamflow routing and field data acquisition systems. The second phase provides for the improvement of flood forecasting procedures for the Red, Assiniboine and Souris rivers.

Research to date has indicated that the conventional forecasting system now in place has the potential, with some improvements, to provide forecasts of comparable accuracy with much less effort than the sophisticated model

(HSPF) investigated under this Agreement. In order to complete these improvements and to meet the objectives of the Agreement, amendments to the Agreement were proposed in this reporting year. Specifically these amendments were an extension in time from March 31, 1986 to September 30, 1989 and additional funding of $400,000 The current Agreement expired at the end of the report year. It is anticipated that the amendment will be approved early in the 1986/87 fiscal year.

I.8 Agreement Respecting the Construction of Flood Protection Projects in Manitoba

The Agreement Respecting the Upgrading of Ring-Dykes in the Red River Valley providing funding to upgrade the ring-dykes at eight communities in the Valley was signed on March 10, 1983. This original Agreement provided up to $4.5 million to raise existing ring-dykes at Emerson, Letellier, Dominion City, St. Jean Baptiste, Morris, Rosenort, Brunkild and St. Adolphe to withstand a 100-year flood. The federal government has agreed to fund 45 per cent of the capital cost of each project while the Province is responsible for 55 per cent. Ring-dykes are the only practical measures to protect existing and future development in these communities. Flood waters spread out for many kilometres in the very flat valley and the alternative of diverting development to areas that are not flood prone is not feasible.

Amendments to the Agreement Respecting the Upgrading of Ring-Dykes in the Red River Valley were signed on May 22, 1985. The amendments consisted of an extension in time to March 31, 1989 and the provision of an additional $1.6 million in funding for upgrading the dyking system at the Village of Ste. Rose du Lac and the construction of a dyke protecting the water treatment plant at the Town of Souris. With the addition of Ste. Rose du Lac and Souris

which are outside of the Red River Valley, the Agreement was renamed "An Agreement Respecting the Construction of Flood Protection Projects in Manitoba".

Negotiation of the Agreement was co-ordinated by the Steering Committee responsible for the Flood Damage Reduction Program. However, the Agreement is not part of that program and is managed and reported on to the Ministers by the Implementation Committee.

CHAPTER II

PROGRAM ORGANIZATION

II.1 Introduction

Under the terms of the General Agreement Respecting Flood Damage Reduction, a Steering Committee was established consisting of two members appointed by the Minister of the Environment for Canada and two members appointed by the Minister of Natural Resources for Manitoba. The Steering Committee provides direction for the program and reports to the Ministers annually.

A Technical Committee on Flood Risk Mapping was established under the terms of the Agreement Respecting Flood Risk Mapping. This committee consists of two members appointed by the Minister of the Environment for Canada and two members appointed by the Minister of Natural Resources for Manitoba. It supervises and conducts the work program of the Agreement Respecting Flood Risk Mapping, and reports to the Steering Committee.

A Studies Sub-Committee was established in mid-1981 by the Steering Committee to oversee the work conducted under the Agreement Respecting Studies for Flood Damage Reduction. This Sub-Committee consists of three members. The federal Co-Chairman of the Steering Committee appointed one member, while the provincial Co-Chairman of the Steering Committee appointed two members. The Chairman of the Studies Sub-Committee reports to the Steering Committee.

A Technical Sub-Committee on Flood Forecasting was established under the terms of the Agreement Respecting Flood Forecasting. It consists of two members appointed by the federal Co-Chairman of the Steering Committee and

two members appointed by the provincial Co-Chairman. This committee supervises and undertakes the task of the Agreement Respecting Flood Forecasting and reports to the Steering Committee.

II.2 Membership: Steering Committee

The membership of the Steering Committee at the end of the reporting year was as follows:

Canada	Manitoba
Mr. R. A. Halliday (Co-Chairman) Regional Director Inland Waters Directorate Western and Northern Region Environment Canada Regina, Saskatchewan	Mr. N. Mudry (Co-Chairman) Chief of Water Management Water Resources Branch Department of Natural Resources Winnipeg, Manitoba
Mr. R. L. Pentland Director Water Planning and Management Inland Waters Directorate Environment Canada Ottawa, Ontario	Mr. J. N. Whiting Director Municipal Planning Branch Department of Municipal Affairs Winnipeg, Manitoba

In accordance with guidelines established in the General Agreement Respecting Flood Damage Reduction, the chairmanship alternated back to the provincial side of the Steering Committee during the ninth year of the program. Mr. Mudry served as chairman at the three meetings held in Winnipeg during the report year. Mr. W. Watters of the Manitoba Department of Natural Resources acted as secretary.

II.3 Membership: Technical Committee on Flood Risk Mapping

The membership of the Technical Committee at the end of the reporting year was as follows:

Canada	Manitoba
Mr. H. Naik (Co-Chairman) Senior Water Resources Planner Water Planning and Management Branch Western and Northern Region Environment Canada Regina, Saskatchewan	Mr. F. P. Barlishen (Co-Chairman) Head Flood Damage Reduction Section Water Resources Branch Department of Natural Resources Winnipeg, Manitoba
Mr. D. Anderson Chief Data Acquisition and Program Planning Topographical Survey Directorate Energy, Mines and Resources Canada Ottawa, Ontario	Mr. W. Leeman Acting Chief Mapping Section Surveys and Mapping Branch Department of Natural Resources Winnipeg, Manitoba

Mr. W. Leeman replaced Dr. Moniwa as the member from the Sruveys and Mapping Branch, Manitoba Department of Natural Resources during the year.

Based on the same guidelines as for the Steering Committee, the federal side resumed the chairmanship for fiscal year 1985/86. Mr. Naik chaired the two meetings held in Winnipeg during the reporting period. Mr. G. Weiss of Environment Canada, Regina served as secretary.

II.4 Membership: Studies Sub-Committee

The membership of the Studies Sub-Committee during the reporting year was as follows:

Canada

Mr. H. Naik (Co-Chairman)
Senior Water Resources Planner
Water Planning and Management Branch
Western and Northern Region
Environment Canada
Regina, Saskatchewan

Manitoba

Mr. F. P. Barlishen (Co-Chairman)
Head
Flood Damage Reduction Section
Water Resources Branch
Department of Natural Resources
Winnipeg, Manitoba

Dr. H. Schellenberg
Agricultural Resource Economist
Department of Agriculture
Winnipeg, Manitoba

Based on the same guidelines as those for the Steering Committee, the provincial side resumed the chairmanship for the fiscal year 1985/86. There were no meetings held during the reporting period as no studies were completed during 1985/86.

II.5 Membership: Technical Sub-Committee on Flood Forecasting

The membership of the Flood Forecasting Sub-Committee at the end of the report year was as follows:

Canada

Mr. R. Hale (Co-Chairman)
Regional Chief
Water Resources Branch
Environment Canada
Winnipeg, Manitoba

Mr. R. Raddatz
Scientific Services Meteorologist
Scientific Services Division
Atmospheric Environment Service
Environment Canada
Winnipeg, Manitoba

Manitoba

Mr. V. M. Austford (Co-Chairman)
Chief of Hydrotechnical Services
Water Resources Branch
Department of Natural Resources
Winnipeg, Manitoba

Mr. R. J. Bowering
Head
Hydrology Section
Water Resources Branch
Department of Natural Resources
Winnipeg, Manitoba

Mr. Hale replaced Mr. Kimmett as the member from Environment Canada. Mr. V. M. Austford was chairman during the report year. Six meetings were held in Winnipeg. Mr. A. Warkentin of the Manitoba Water Resources Branch acted as secretary.

CHAPTER III

PROGRAM IMPLEMENTATION

III.1 Scope

Originally, flood risk maps and flood damage reduction studies were to be prepared for 45 communities in Manitoba as listed in Schedule A of the Agreement Respecting Flood Risk Mapping (this schedule with amendments and additions is shown as Appendix A). A location map is attached as Appendix B. However, Canada and Manitoba signed an agreement on March 10, 1983 to share the cost of upgrading existing dyking systems to the one per cent flood protection level in eight of these communities. Therefore, mapping or studies are not necessary for the communities of Emerson, Letellier, Dominion City, St. Jean Baptiste, Morris, Rosenort, Brunkild or St. Adolphe. As for Ste. Rose du Lac, although the base maps have been completed, no flood risk mapping studies will be done as plans are under way to upgrade the flood protection works in the community under the Agreement Respecting the Construction of Flood Protection Projects in Manitoba.

Flood risk areas are determined and plotted on detailed engineering maps and smaller scale public information maps. Policies which discourage further flood prone development come into effect when the Minister of the Environment for Canada and the Minister of Natural Resources for Manitoba designate the flood risk areas.

In communities where flood damage reduction studies are deemed necessary, an analysis is undertaken to determine the most economical and suitable measures to protect existing development from future flood damages. Agreements are negotiated to fund the construction of flood protection works,

if such works are shown to be feasible and economically viable.

Research into developing improved flood forecasting procedures for the Red, Assiniboine and Souris rivers in Manitoba was conducted under the Agreement Respecting Flood Forecasting. This involved calibration of the HSPF hydrologic model on key tributaries of these rivers. Research into developing new forecasting procedures was concluded in the report year. Future efforts will be directed towards improving the conventional forecasting system, mainly through improved data input and further computerization.

III.2 Schedule

During the first year of the Flood Damage Reduction Program, a community work program schedule was prepared for the 45 centres to be mapped, based on flood history, and recognizing the potential for future developments in undeveloped urban flood prone areas. Since then, the City of Winnipeg and the Additional Zone were added to Schedule A, the General Agreement Respecting Flood Damage Reduction was extended to 1994, the Agreement Respecting Flood Risk Mapping to 1988, the Agreement Respecting Studies for Flood Damage Reduction to 1989, Phase One of the Agreement Respecting Flood Forecasting to 1984 and Phase Two to 1986. A further extension to the Agreement Respecting Flood Forecasting was requested in the report year.

III.3 Methodology

III.3.1 Flood Risk Mapping

The work program at each community for the flood risk mapping and flood damage reduction (FDR) studies begins with the preparation of 1:2000 scale topographic base maps showing

planimetric and height information. Base map production is carried out in four steps, namely, aerial photography, control survey, aerial triangulation and map compilation.

Following the map preparation, hydrologic studies are undertaken to determine the magnitude of the design flood and the watershed's response to flood-generating events. The results of these studies function as an input to the hydraulic studies which systematically define design flood water surface profiles throughout the communities. The resulting flood risk lines are delineated on the base maps which are then used for engineering and planning purposes.

The Steering and Technical committee consult with the local government officials to ensure a local awareness of the intent and implications of the program. They also review the delineation of the flood lines with the local officials to seek their support in the implementation of the policies of the program.

When the Steering Committee has concurred in the delineation of the flood risk area and floodway (where applicable), the preliminary flood lines, which are plotted on the 1:2000 scale maps, are presented to the local councils for their comments. The Ministers are then asked for their approval of the designation and public information maps and brochures are prepared.

The public information program is conducted concurrently with the mapping process. The residents of the community

are made aware of the Flood Damage Reduction Program through meetings, brochures, maps and the media.

III.3.2 Flood Damage Reduction Studies

Flood damage reduction studies are undertaken for selected communities. The purpose is to determine the measure which has the most favourable benefit-cost ratio for minimizing flood damage potential of existing development and also to guide future floodplain development practices. The studies describe present land uses, assess potential flood damages and identify and evaluate alternatives for reducing the potential for flood damage. Among the range of measures considered are structural and non-structural alternatives such as dyking, floodproofing, flood forecasting systems, emergency action and zoning. Zoning and formulation of by-laws for flood prone lands at the local government level are encouraged by program officials.

In a community where a dyke exists, the flood damage reduction study would include a geotechnical study of the dyke to assess the dyke's stability and to determine the requirement, if any, for upgrading the dyke to a standard acceptable under the Flood Damage Reduction Program. A survey by questionnaire or some other means would be undertaken in some communities where a recent large flood occurred. This survey would be conducted to determine the exact extent of damage caused by that flood. The results can be used to estimate the damages

that would be caused by other floods up to the design flood. A field survey is conducted in most communities to determine the first floor elevations of all structures in the flood risk area. The study report is used as the basis for a recommendation to governments on construction of flood mitigation works or implementation of non-structural measures such as the purchase of flood prone properties.

III.3.3 Flood Forecasting

The Flood Forecasting Program is divided into two phases. Phase One, which was completed on February 3, 1984, consisted mainly of a review of streamflow simulation models and testing and evaluation of the most promising models on the Boyne River. Results of the detailed testing were analyzed and forecast accuracies were compared to those of current methods. The applicability of the models to other watersheds in the Assiniboine, Red and Souris river basins was assessed to ensure that the selected model could be used throughout the study area. Other work in Phase One included establishment and testing of real-time hydrometeorological data acquisition systems and an evaluation of stream channel routing procedures. Phase Two originally provided for the further refining of the model for its application to the Red, Assiniboine and Souris watersheds. However, the study has indicated that the conventional forecasting methodology currently in place has the potential, with improvements, to provide forecasts of similar accuracy with significantly less effort.

III.4 Work Assignments

All work activities under the Flood Damage Reduction Program are conducted under the general direction of the Steering Committee. The Flood Risk Mapping Technical Committee, the Studies Sub-Committee and the Flood Forecasting Sub-Committee supervise the work in their respective programs, and report to the Steering Committee on progress of work and on major issues.

The 1:2000 base maps and smaller scale public information maps completed to date have been compiled by private contractors. The inspection responsibility has been vested in the Director of Topographical Survey Division, Surveys and Mapping Branch of the Federal Department of Energy, Mines and Resources with the exception of the inspection of the aerial photography and survey control which, de facto, has been the responsibility of the Surveys and Mapping Branch of the Manitoba Department of Natural Resources. The Manitoba Surveys and Mapping Branch (MSMB) has been responsible for the administration of tender invitation and awarding all contract works in accordance with the provincial contracting policies and the Agreement Respecting Flood Risk Mapping. The MSMB has also agreed to compile the 1:2000 base maps for several communities.

The Water Resources Branch of the Manitoba Department of Natural Resources (MWRB) conducts all of the hydrologic and the majority of the hydraulic studies. Some hydraulic studies had been done by consultants and by Environment Canada. The MWRB is responsible for the administration of hydraulic study contracts. Cross section surveys of the river channels are undertaken by the Engineering and Construction Branch of the Manitoba Department of Natural Resources.

The MWRB and Environment Canada, Regina, jointly conduct the public information program. Public Information Services of the Manitoba Department of Natural Resources plays an important role in this program by preparing brochures for each community, liaising with local officials, arranging meetings with local councils and the public, preparing publicity for meetings, and providing information to all government agencies and municipalities on the implications of the Flood Damage Reduction Program.

The MWRB plays the lead role in the forecasting studies under the Flood Forecasting Program. The Inland Waters Directorate and the Atmospheric Environment Service of Environment Canada, Winnipeg play the lead role in testing the real-time hydrometeorological data acquisition system. The Water Planning and Management Branch of Environment Canada in Ottawa is evaluating the applicability of dynamic channel routing model on the Red River in Manitoba.

The Manitoba Department of Natural Resources provides the initial funding for the program and submits statements to Environment Canada for cost-sharing. Under the supervision of the Technical Committee, the MWRB is responsible for the overall administration of all contracts under the Flood Damage Reduction Program.

III.5 Expenditures

The Agreement Respecting Flood Risk Mapping originally provided for a total expenditure of $700,000 over five years. The Amending Agreement provided an additional $1,490,000 to complete most of the required mapping. An additional $160,000 was provided in 1985/86 by extension to the Agreement which was signed on September 6, 1985. A total of $310,000 is available for flood damage reduction studies under the Agreement Respecting Studies for Flood

Damage Reduction. A total of $600,000 has been allocated to implement the Agreement Respecting Flood Forecasting. An additional $400,000 was requested for the Agreement in 1985/86.

Expenditures from December 20, 1976 to March 31, 1986 are summarized in Table I. These costs were shared equally by Canada and Manitoba.

CHAPTER IV

ACTIVITIES UNDER THE FLOOD DAMAGE REDUCTION AGREEMENTS 1985-86

IV.1 Flood Risk Mapping Program

IV.1.1 Designation

The Agreement Respecting Flood Risk Mapping expired on December 31, 1984. The Amending Letters of Exchange, which include a time extension and additional funding for this Agreement, were signed on September 6, 1985. As a result, no designation took place during the report year. The following designations have been made under the program:

Melita	-	Interim	-	December 20, 1979
Wawanesa	-	Interim	-	December 20, 1979
Winnipeg	-	Interim	-	February 15, 1980
Souris	-	Final	-	October 1, 1980
Elie	-	Final	-	November 5, 1980
Brandon	-	Final	-	March 26, 1982
Starbuck	-	Final	-	November 26, 1982
Sanford	-	Final	-	November 26, 1982
La Salle	-	Final	-	November 26, 1982
Swan River	-	Final	-	May 11, 1982
Dauphin	-	Final	-	February 15, 1984
Carman	-	Final	-	June 13, 1984
Lorette	-	Final	-	September 13, 1984

IV.1.2 Arborg: Icelandic River

The hydrology study at Arborg was reviewed by the Manitoba Water Resources Branch. The review indicated that the design flood levels could be lowered. The Council of the Village of Arborg was informed of the new design flood levels which have been adopted.

IV.1.3 Fisher Branch: Fisher River

The hydraulic study was completed by the Manitoba Water Resources Branch.

IV.1.4 Gimli: Gimli Airport Drain

No work was done during the period of this report.

IV.1.5 Gladstone: Whitemud River

No work was done during the period of this report.

IV.1.6 Grande Pointe: Seine River

No work was done during the period of this report.

IV.1.7 Gretna: Pembina River

No work was done during the period of this report.

IV.1.8 La Riviere: Pembina River

No work was done during the period of this report.

IV.1.9 MacGregor: Beaver Creek

No work was done during the period of this report.

IV.1.10 Melita: Souris River

Interim designation has been in effect since December 20, 1979. No work was done towards final designation during the period of this report.

IV.1.11 Minnedosa: Little Saskatchewan River

No work was done during the period of this report.

IV.1.12 Morden: Dead Horse Creek

The Council of the Town of Morden has not indicated their concurrence in designating the flood risk area in the Town. Discussions are continuing between the Steering Committee responsible for the Flood Damage Reduction Program and the Town Council.

IV.1.13 Neepawa: Whitemud River

Environment Canada is continuing the work on the hydraulic study.

IV.1.14 Ochre River: Ochre River

No work was done during the period of this report.

IV.1.15 Riverton: Icelandic River

The hydraulic study was completed by the Manitoba Water Resources Branch.

IV.1.16 Ste. Anne: Seine River

No work was done during the period of this report.

IV.1.17 Ste. Rose du Lac: Turtle River

No work was done during the period of this report. Plans are under way to include proposed improvements to existing flood

protection works under the Agreement Respecting the Construction of Flood Protection Projects in Manitoba.

IV.1.18 Souris: Souris River

No work was done during the period of this report. Plans are under way to include upgrading of the dyke protecting the water treatment plant at Souris under the Agreement Respecting the Construction of Flood Protection Projects in Manitoba.

IV.1.19 The Pas: Saskatchewan River

Work continued on the base mapping, which is being conducted by the Manitoba Surveys and Mapping Branch.

IV.1.20 Virden: Bosshill, Gopher, and Scallion Creeks

A meeting was held with the Council of the Town of Virden to explain the aims and objectives of the Flood Damage Reduction Program. Work continued on the base mapping, which is being conducted by the Manitoba Surveys and Mapping Branch.

IV.1.21 Wawanesa: Souris River

Interim designation took place on December 20, 1979. No work was done towards final designation during the period of this report.

IV.1.22 Westbourne: Whitemud River

No work was done during the period of this report.

IV.1.23 Winnipeg

IV.1.23.1 Omands Creek

Hydrology and hydraulic studies to determine the one per cent flood conditions were initiated. Work is being done by the Manitoba Water Resources Branch. Cross section survey information and base maps suitable for interim designation were available prior to the initiation of the hydraulic study.

IV.1.23.2 Red and Assiniboine Rivers and Tributaries

Work continued on the base mapping of the unmapped areas along the Assiniboine, La Salle and Red rivers within the city limits. This work is being done by the Manitoba Surveys and Mapping Branch.

IV.1.24 Woodside: Whitemud River

No work was done during the period of this report.

IV.1.25 Remaining Communities

As was reported in past annual reports, no work is planned for Hartney, Horndean, Rosenfeld and Thompson because of the low flood potential. Also, flood risk mapping will not proceed at Brunkild, Dominion City, Emerson, Letellier, Morris, Rosenort, St. Adolphe, St. Jean Baptiste and Ste. Rose du Lac as the Agreement Respecting the Construction of Flood Protection Projects in Manitoba will upgrade the level of protection offered by the existing dykes at these communities to conform to the one

per cent flood level. This level has been adopted as a minimum standard for the Manitoba FDR program.

IV.1.26 Field Survey Checks of Topographic Mapping

The field work of the survey checking program was completed this year. The objective of the program was to verify the accuracy of the mapping. This information may be useful in determining whether the accuracy of the maps will allow final or only interim designation to take place. The cost of the checking program is being borne by Energy, Mines and Resources Canada.

IV.2 Flood Damage Reduction Studies Program

IV.2.1 Elie

The Manitoba Water Resources Branch is continuing work on the flood damage reduction study.

IV.2.2 Morden

The Manitoba Water Resources Branch is continuing work on the flood damage reduction study.

IV.2.3 Riverton

The Manitoba Water Resources Branch is continuing work on the flood damage reduction study.

IV.3 The Flood Forecasting Program

A report detailing the work on Phase One of the Agreement Respecting Flood Forecasting was completed. A public information brochure on flood forecasting in Manitoba was almost completed. Work continued on Phase Two. The calibration and verification of the HSPF model on Willow Creek, Gopher Creek and Elgin Creek was almost completed.

Some funding from the Agreement was provided to the Atmospheric Environment Service for the development of a telidon weather radar system. The system will enable radar images of weather patterns to be stored on computer. This information will be accessible by the Canada-Manitoba Flood Forecasting Centre for visual display and for use in flood forecasting. Four Nipher-shielded snow gauges and a Belfort precipitation gauge have also been acquired.

A meeting was held between the Technical Sub-Committee and the United States National Weather Services. Methodologies on flow forecasting were discussed and procedures for exchanging data were established.

The Ottawa office of the Inland Waters Directorate continued work on the application of the One-Dimensional dynamic streamflow routing model for the Red River from Emerson to Winnipeg.

TABLE I
CANADA-MANITOBA FLOOD DAMAGE REDUCTION PROGRAM
EXPENDITURES FOR 1977/86

	1977	1978/79	1979/80	1980/81	1981/82	1982/83	Total 1977/83
GENERAL AGREEMENT	$ 1,000.00	$ 1,254.91	--	$ 478.10	$ 664.88	$ 42.00	$ 3,439.89
General Mapping	--	19,083.18	19,067.79	46,784.60	38,534.97	71,081.64	194,552.18
Arborg	--	--	--	10,667.29	11,212.08	6,583.48	28,462.85
Assiniboine River	--	--	--	1,032.00	--	--	1,032.00
Brandon	--	--	81,502.96	75,457.90	32,798.75	4,131.64	193,891.25
Carman	17,082.12	21,957.83	6,577.98	23,815.41	15,361.80	389.38	85,184.52
Dauphin	--	--	19.70	39,746.68	34,095.53	11,161.48	85,023.39
Elie	22,817.76	27,270.36	6,798.22	9,040.40	487.05	174.91	66,588.70
Fisher Branch	--	--	--	8,802.96	12,838.20	12,806.15	34,447.31
Gimli	--	--	--	22.55	31,333.93	1,373.00	32,729.48
Gladstone	--	--	--	12,208.25	21,558.28	2,442.35	36,208.88
Grande Pointe	--	--	21.55	14,760.86	11,969.46	--	26,751.87
Gretna	--	--	--	414.00	17,943.40	365.00	18,722.40
Hartney	--	--	--	323.00	91.00	--	414.00
Horndean	--	--	--	403.00	91.00	--	494.00
La Riviere	--	--	--	251.00	31,189.27	4,339.96	35,780.23
La Salle	--	8,162.39	5,673.36	14,573.01	7,862.49	4,563.43	40,834.68
Lorette	--	--	--	624.55	21,910.29	18,293.59	40,828.43
MacGregor	--	--	--	6,092.13	28,415.53	1,850.47	36,358.13
Melita	8,806.00	9,536.44	2,102.46	10,172.60	56.42	430.78	31,104.70
Minnedosa	--	--	--	12,478.02	20,989.65	3,354.27	36,821.94
Morden	--	--	2,631.07	20,373.18	23,670.63	25,407.61	72,082.49
Neepawa	--	--	16,088.39	28,785.60	33,242.27	5,118.02	83,234.28
Ochre River	--	--	--	19,271.85	5,756.92	--	25,028.77
Ritchot	4,772.39	13,700.31	--	312.00	--	--	18,784.70
Riverton	--	--	--	6,052.92	15,129.77	4,483.00	25,665.69
Rosenfeld	--	--	--	427.00	14,350.09	253.00	15,030.09
Ste Anne	--	--	--	482.00	32,963.33	13,064.86	46,510.19
Ste Rose du Lac	--	--	14,219.19	16,657.66	12,273.59	4,860.16	48,010.60
Sanford	--	--	12,939.42	11,577.82	5,990.65	5,190.43	35,698.32
Souris	14,615.24	13,515.46	3,464.92	11,088.76	44.82	711.69	43,440.89
Starbuck	--	--	7,382.93	13,239.36	27,204.80	16,029.98	63,857.07
Swan River	--	--	--	17,206.72	17,851.50	9,370.26	44,428.48
The Pas	--	--	--	581.00	33,909.89	24,141.17	58,632.06
Thompson	--	--	--	433.00	14.00	--	447.00
Virden	--	--	--	146.00	38,866.04	13,250.51	52,262.55
Wawanesa	4,491.00	4,063.76	7,034.36	12,374.19	17.78	430.78	28,411.87
Westbourne	--	--	--	8,239.27	6,148.00	5,167.20	19,554.47
Winnipeg	--	37,563.98	47,660.87	9,585.35	3,461.52	4,724.14	102,995.86
Woodside	--	--	--	1,336.41	1,554.51	5,776.46	8,667.38
Brochure	3,500.00	--	--	--	--	--	3,500.00
TOTAL MAPPING	$76,084.51	$154,853.71	$233,185.17	$465,840.30	$611,189.21	$281,320.80	$1,822,473.70
General Studies	--	--	2,177.48	--	2,452.70	8,082.01	12,712.19
Brandon	--	--	--	--	15,117.52	6,298.16	21,415.68
Carman	--	--	476.85	--	--	--	476.85
Gimli	--	--	--	--	2,817.49	60.00	2,877.49
Gladstone	--	--	--	--	--	299.61	299.61
Letellier	--	--	--	--	575.93	--	575.93
Morden	--	--	--	--	--	3,146.21	3,146.21
Morris	--	--	--	--	195.25	--	195.25
Ste Rose du Lac	--	--	--	3,982.87	8,826.82	1,215.20	14,024.89
Souris	--	--	--	--	4,389.62	1,215.20	5,571.77
Wawanesa	--	--	1,320.00	--	--	--	1,320.00
Winnipeg	--	--	4,368.65	261.08	361.98	--	4,991.71
TOTAL STUDIES	--	--	$ 8,342.98	$ 4,243.95	$ 34,737.31	$ 20,283.34	$ 67,607.58
FLOOD FORECASTING	--	--	--	--	69,947.66	170,137.00	240,084.66
GRAND TOTAL	$77,084.51	$156,108.62	$241,528.15	$470,562.35	$716,539.06	$471,783.14	$2,133,605.83

continued . . .

TABLE I (Continued)
CANADA-MANITOBA FLOOD DAMAGE REDUCTION PROGRAM
EXPENDITURES FOR 1977/86

	1983/84	1984/85	1977/85 Total
GENERAL AGREEMENT	$ -	$ -	$ 3,439.89
General Mapping	56,429.23	39,223.22	293,844.45
Arborg	12,548.35	758.14	41,769.34
Assiniboine River	-	-	1,032.00
Brandon	1,454.00	-	195,345.25
Carman	810.00	6,316.15	92,310.67
Dauphin	8,732.03	6,099.25	99,854.67
Elie	1,357.25	-	67,945.95
Fisher Branch	19,683.03	7,812.66	61,943.00
Gimli	-	-	32,729.48
Gladstone	5,073.58	10,731.74	52,014.20
Grande Pointe	2,006.97	-	28,758.84
Gretna	-	-	18,722.40
Hartney	-	-	414.00
Horndean	-	-	494.00
La Riviere	-	-	35,780.23
La Salle	72.48	-	40,907.16
Lorette	6,809.60	4,235.61	51,873.64
MacGregor	29.97	-	36,388.10
Melita	-	-	31,104.70
Minnedosa	544.21	12,343.65	49,709.80
Morden	27,302.71	4,115.90	103,501.10
Neepawa	561.33	28,840.80	112,636.41
Ochre River	199.30	-	25,228.07
Ritchot	-	-	18,784.70
Riverton	16,382.52	9,119.84	51,168.05
Rosenfeld	-	-	15,030.09
Ste. Anne	319.42	-	46,829.61
Ste. Rose du Lac	-	-	48,010.60
Sanford	72.46	-	35,770.78
Souris	-	-	43,440.89
Starbuck	1,651.61	-	65,508.68
Swan River	6,182.67	-	50,611.15
The Pas	18,866.90	-	77,498.96
Thompson	-	-	447.00
Virden	7,547.42	-	59,809.97
Wawanesa	-	-	28,411.87
Westbourne	3,505.82	-	23,060.29
Winnipeg	9,624.95	-	112,620.81
Woodside	-	-	8,667.38
Brochure	-	-	3,500.00
TOTAL MAPPING	$207,767.81	$129,596.96	$2,163,478.29
General Studies	$ -	$ 8,691.18	$ 20,155.83
Brandon	-	-	21,415.68
Carman	-	-	476.85
Elie	-	3,657.17	3,657.17
Gimli	-	-	2,877.49
Gladstone	-	-	299.61
Letellier	-	-	575.93
Morden	411.55	7,371.52	10,929.28
Morris	-	-	195.25
Riverton	-	6,848.73	6,848.73
Ste. Rose du Lac	-	-	14,024.89
Souris	-	-	5,571.77
Wawanesa	-	-	1,320.00
Winnipeg	-	-	4,991.71
TOTAL STUDIES	$ 411.55	$ 26,568.60	$ 93,340.19
Flood Forecasting			
- Phase I	$109,858.63	$ -	$ 353,610.77
- Phase II	15,887.29	118,349.63	134,236.92
TOTAL FLOOD FORECASTING	$125,745.92	$118,349.63	$ 487,855.69
GRAND TOTAL	$333,925.28	$274,515.19	$2,748,114.06

TABLE I (Continued)
CANADA-MANITOBA FLOOD DAMAGE REDUCTION PROGRAM
EXPENDITURES FOR 1977/86

	GENERAL AGREEMENT	
	1985/86	1977/86 Total
TOTAL	$ -	$ 3,439.89

	MAPPING AGREEMENT		STUDIES AGREEMENT	
	1985/86	1977/86 Total	1985/86	1977/86 Total
General	$ 9,299.64	$ 303,144.09	$ 39,294.33	$ 59,450.16
Arborg	3,616.35	45,385.69	-	-
Assiniboine River	-	1,032.00	-	-
Brandon	-	195,345.25	-	21,415.68
Carman	45.00	92,355.67	-	476.85
Dauphin	58.50	99,913.17	-	-
Elie	-	67,945.95	13,562.22	17,219.39
Fisher Branch	6,547.29	68,490.29	-	-
Gimli	-	32,729.48	-	2,877.49
Gladstone	-	52,014.20	-	299.61
Grande Pointe	-	28,758.84	-	-
Gretna	-	18,722.40	-	-
Hartney	-	414.00	-	-
Horndean	-	494.00	-	-
La Riviere	-	35,780.23	-	-
La Salle	-	40,907.16	-	-
Letellier	-	-	-	575.93
Lorette	777.50	52,651.14	-	-
MacGregor	-	36,388.10	-	-
Melita	-	31,104.70	-	-
Minnedosa	-	49,709.80	-	-
Morden	4,581.00	108,082.10	21,034.43	31,963.71
Morris	-	-	-	195.25
Neepawa	3,454.34	116,090.75	-	-
Ochre River	-	25,228.07	-	-
Ritchot	-	18,784.70	-	-
Riverton	1,814.31	52,982.36	22,474.67	29,323.40
Rosenfeld	-	15,030.09	-	-
Ste. Anne	-	46,829.61	-	-
Ste. Rose du Lac	-	48,010.60	-	14,024.89
Sanford	-	35,770.78	-	-
Souris	-	43,440.89	-	5,571.77
Starbuck	-	65,508.68	-	-
Swan River	-	50,611.15	-	-
The Pas	373.38	77,872.34	-	-
Thompson	-	447.00	-	-
Virden	373.39	60,183.36	-	-
Wawanesa	-	28,411.87	-	1,320.00
Westbourne	-	23,060.29	-	-
Winnipeg	-	112,620.81	69.87	5,061.58
Omands Creek	5,830.96	5,830.96	-	-
Woodside	-	8,667.38	-	-
Brochure	-	3,500.00	-	-
TOTAL	$36,771.66	$2,200,249.95	$ 96,435.52	$ 189,775.71

	FLOOD FORECASTING	
	1985/86	1977/86 Total
- Phase One	-	353,618.77
- Phase Two	102,294.36	236,531.28
TOTAL	$102,294.36	$ 590,150.05
GRAND TOTAL OF ALL AGREEMENTS	$235,501.54	$2,983,615.60

APPENDIX "A"

AREAS AND FLOODWAYS TO BE MAPPED IN THE PROVINCE OF MANITOBA

PLACE	BODY OF WATER	WHETHER FLOODWAY IS TO BE DELINEATED
Brandon and R.M. of Cornwallis	Assiniboine River from west of 21-10-19 W.P.M. to east of 19-10-18 W.P.M.	No
R.M. of Portage la Prairie, R.M. of St. Francois Xavier, R.M. of Cartier and the City of Winnipeg	Assiniboine River from Portage la Prairie to the western limit of the City of Winnipeg	No
Carman and R.M. of Dufferin	Boyne River from west of 23-6-5 W.P.M. to east of 29-6-4 W.P.M.	Yes
Gimli and R.M. of Gimli	Overflows from the Gimli Airport Drain. Area to be mapped to be shown on location plan.	Yes
Thompson and L.G.D. of Mystery Lake	Burntwood River (to be shown on location plan)	No
Fisher Branch and L.G.D. of Fisher	Fisher River from west of 14-24-2 W.P.M. to east of 24-24-2 W.P.M.	Yes
Arborg and R.M. of Bifrost	Icelandic River from west of 22-22-2 E.P.M. to east of 24-22-2 E.P.M.	Yes
Riverton and R.M. of Bifrost	Icelandic River from south of 17-23-4 E.P.M. to north of 21-23-4 E.P.M.	Yes
Rosenort and R.M. of Morris	Morris River from south of 6-6-1 E.P.M. to north of 7-6-1 E.P.M.	No
Brunkild and R.M. of MacDonald	Morris River from south of 19-7-1 W.P.M. to north of 30-7-1 W.P.M.	No
Minnedosa and R.M. of Minto	Minnedosa River from west of 3-15-18 W.P.M. to north of 1-15-18 W.P.M.	Yes

PLACE	BODY OF WATER	WHETHER FLOODWAY IS TO BE DELINEATED
Ochre River and R.M. of Ochre River	Ochre River from south of 9-24-17 W.P.M. to north of 15-24-17 W.P.M.	Yes
Gretna and R.M. of Rhineland	Pembina River (in 5-1-1 W.P.M.)	Yes
La Riviere and R.M. of Pembina	Pembina River from west of 25-3-10 W.P.M. to south of 19-3-9 W.P.M.	No
Emerson and R.M. of Montcalm and R.M. of Franklin	Red River from International Boundary to north of 12-1-2 E.P.M.	No
Letellier and R.M. of Montcalm	Red and Aux Marais Rivers from south of 18-2-2 E.P.M. to east of 20-2-2 E.P.M.	No
Morris and R.M. of Morris	Red and Morris Rivers from east of 35-4-1 E.P.M. to east of 2-5-1 E.P.M.	No
St. Jean Baptiste and R.M. of Montcalm	Red and Plum Rivers from south of 36-3-1 E.P.M. to north of 1-4-1 E.P.M.	No
R.M. of Ritchot and the City of Winnipeg	Red River from southern limit of R.M. of Ritchot to Red River Floodway Control Structure	Yes
Elie and R.M. of Cartier	La Salle River from north of 11-11-3 W.P.M. to south of 2-11-3 W.P.M.	Yes
Starbuck and R.M. of MacDonald	La Salle River from west of 26-9-2 W.P.M. to east of 25-9-2 W.P.M.	Yes
Sanford and R.M. of MacDonald	La Salle River from north of 30-8-1 E.P.M. to south of 29-8-1 E.P.M.	Yes
R.M. of Ritchot, R.M. of MacDonald and the City of Winnipeg	La Salle River from east of 32-8-2 E.P.M. to Red River	Yes
Dominion City and R.M. of Franklin	Roseau River from north of 19-2-3 E.P.M. to east of 20-2-3 E.P.M.	No
The Pas and L.G.D. of Consol	Saskatchewan River Pasquia River to Rahl's Island	Yes
Grande Pointe and R.M. of Ritchot	Seine River from Grande Pointe (west of 20-9-4 E.P.M.) to Red River Floodway	Yes

PLACE	BODY OF WATER	WHETHER FLOODWAY IS TO BE DELINEATED
Lorette and R.M. of Tache	Seine River from west of 8-9-5 E.P.M. to the quarter section line of 9-9-5 E.P.M.	Yes
Ste. Anne	Seine River within the village of Ste. Anne	Yes
Winnipeg	Sturgeon Creek from P.T.H. No. 101 to Assiniboine River	No
Melita and R.M. of Arthur	Souris River from west of 31-3-26 W.P.M. to east of 6-4-26 W.P.M.	No
Hartney and R.M. of Cameron	Souris River from Hartney Dam to west of 17-6-23 W.P.M.	No
Souris and R.M. of Glenwood	Souris River from south of 33-7-21 W.P.M. to one half mile east of P.R. 250	No
Wawanesa and the R.M. of Oakland	Souris River from west of 23-7-17 W.P.M. to east of 26-7-17 W.P.M.	No
Swan River and R.M. of Swan River	Swan River from south of 26-36-27 E.P.M. to east of 28-36-27 W.P.M.	Yes
Ste. Rose du Lac and R.M. of Ste. Rose	Turtle River from Ste. Rose Dam to north of 8-24-15 W.P.M.	Yes
Dauphin and R.M. of Dauphin	Vermillion River from quarter section line of 4-25-19 W.P.M. to north of 15-25-19 W.P.M.	Yes
Gladstone and R.M. of Westbourne	Whitemud River from west of 30-14-11 W.P.M. to east of 32-14-11 W.P.M.	Yes
Westbourne and R.M. of Westbourne	Whitemud River from P.T.H. No. 4 to north of 25-13-9 W.P.M.	Yes
Woodside and R.M. of Westbourne	Whitemud River from west of 16-14-10 W.P.M. to east of 9-14-10 W.P.M.	Yes
Neepawa and R.M. of Langford	Whitemud River from southern Town Limit to north of 34-14-15 W.P.M.	No
Morden and R.M. of Stanley.	Dead Horse Creek from Morden Dam to north of 8-3-5 W.P.M.	Yes
Virden and R.M. of Wallace	Gopher Creek from north of 27-10-26 W.P.M. to south of 15-10-26 W.P.M.	Yes

PLACE	BODY OF WATER	WHETHER FLOODWAY IS TO BE DELINEATED
Horndean and R.M. of Rhineland	Hespeler Channel from quarter section Line of 9-3-2 W.P.M. to quarter section line of 10-3-2 W.P.M.	Yes
Rosenfeld and R.M. of Rhineland	Overflows from Hespeler Channel. Area to be mapped to be shown on location plan	Yes
MacGregor and R.M. of North Norfolk	Beaver Creek. Area to be mapped to be shown on location plan	Yes
Winnipeg and Additional Zone	Red and Assiniboine Rivers and Tributaries	Yes

APPENDIX B

Location of Areas
in the Canada – Manitoba Flood Risk
Mapping Agreement

LEGEND:

- ● Designated areas
- ○ Areas to be designated